Electronic Version

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Claims

[c1] 1. A composition of a nano-tube compositepolymer electrolyte, comprising:

a polymer substrate having main-chains and side-chains, which at least have an ether group, an acyl group, an amino group, a fluoro group or a Lewis base functional group;

a metal salt comprising a metal cation and an anion, wherein the metal salt and the polymer substrate form a polymer salt complex; and

a nano-tube modifier forming Lewis acid-base force with the polymer substrate and the polymer salt complex.

[c2] 2. The composition of a nano-tube compositepolymer electrolyte of claim 1, wherein a surface of the nano-tube modifier has functional groups OR and O .

[c3] 3. The composition of a nano-tube compositepolymer electrolyte of claim 1, wherein the nano-tube modifier is selected from a group consisting of TiO_2, SiO_2 and Al_2O_3.

[c4] 4. The composition of a nano-tube compositepolymer electrolyte of claim 1, wherein a diameter of the nano-

tube modifier is about from 50 nm to about 160 nm.

[c5] 5. The composition of a nano-tube compositepolymer electrolyte of claim 1, wherein a length/width ratio of the nano-tube modifier is more than 8.

[c6] 6. The composition of a nano-tube compositepolymer electrolyte of claim 1, wherein the polymer substrate is about from 30% to about 90% by weight; the metal salt is about from 2% to about 30% by weight; and the nano-tube modifier is about from 3% to about 30% by weight.

[c7] 7. The composition of a nano-tube compositepolymer electrolyte of claim 1, wherein the polymer substrate is about from 60% to about 90% by weight; the metal salt is about from 2% to about 50% by weight; and the nano-tube modifier is about from 1% to about 20% by weight.

[c8] 8. The composition of a nano-tube compositepolymer electrolyte of claim 1, wherein the Lewis base functional group is selected from a group consisting of oligo(oxyalkylene), flouralkyl group, fluoralkylene, carbonate group, cyano group and sulfonyl group.

[c9] 9. The composition of a nano-tube compositepolymer electrolyte of claim 1, wherein the polymer substrate is selected from a group consisting of polyalkylene oxide, polyvinyl fluoride, polyacrylonitrile, polyester, polyether,

polysulfone, polyethylene oxide, polyvinylidene fluoride, poly(methyl methacrylate) (PMMA), polysiloxane, polyphosphazene or derivates thereof.

[c10] 10. The composition of a nano-tube compositepolymer electrolyte of claim 3, wherein a weight-average molecular weight of the polymer substrate is from about 1000 to about 1,000,000.

[c11] 11. The composition of a nano-tube compositepolymer electrolyte of claim 1, wherein the cation is selected from a group consisting of an alkaline-earth metal ion, an alkali metal ion and a transitional metal ion; and the anion is selected from a group consisting of ClO_4^-, $S_2O_8^{2-}$, BF_4^-, AsF_6^-, PF_6^- and TeF_6^-.

[c12] 12. A method for fabricating a nano-tube compositepolymer electrolyte, comprising:
mixing a nano-tube modifier and an anhydrous solvent and adding a polymer substrate therein;
heating and completely stirring the nano-tube modifier and the polymer substrate for generating a polymer electrolyte, wherein the stirring step is performed with the assist of microwave or ultrasonic; and
putting the polymer electrolyte in a container and removing the solvent for forming a film.

[c13] 13. The method for fabricating a nano-tube composite polymer electrolyte of claim 12, wherein the nano-tube modifier is selected from a group consisting of TiO_2, SiO_2 and Al_2O_3.

[c14] 14. The method for fabricating a nano-tube composite polymer electrolyte of claim 12, wherein a dielectric constant of the anhydrous solvent is higher than 20.

[c15] 15. The method for fabricating a nano-tube compositepolymer electrolyte of claim 12, wherein the anhydrous solvent comprises high dielectric solvent such as tetrahydrofuran (THF).

[c16] 16. The method for fabricating a nano-tube compositepolymer electrolyte of claim 12, further comprising performing an electrical field treatment for the film at a temperature higher than the Tg of the polymer and cooling down to room temperature.

[c17] 17. The method for fabricating a nano-tube compositepolymer electrolyte of claim 16, wherein an electrical field of the electrical field treatment is from about 200 to about 10,000 V/cm.

[c18] 18. The method for fabricating a nano-tube compositepolymer electrolyte of claim 16, wherein a process time of the electrical field treatment is from about 1 hr

to about 90 hrs.

[c19] 19. A method for fabricating a solid-state polymer electrolyte film, comprising:
mixing a nano-tube modifier and an anhydrous solvent and adding a metal salt and a polymer substrate therein;heating and completely stirring the nano-tube modifier, the anhydrous solvent, the metal salt and the polymer substrate for generating a uniform solution, wherein the stirring step is performed with the assist of microwave or ultrasonic;
coating the uniform solution on a plate electrode, a container or a surface of an object; and
removing the solvent for forming a polymer electrolyte film.

[c20] 20. The method for fabricating a solid-state polymer electrolyte film of claim 19, further comprising performing an electrical field treatment for the polymer electrolyte film at a temperature higher than a Tg of the polymer substrate and cooling down to room temperature.

[c21] 21. The method for fabricating a solid-state polymer electrolyte film of claim 20, wherein an electrical field of the electrical field treatment is from about 200 to about 10,000 V/cm.

[c22] 22. The method for fabricating a solid-state polymer electrolyte film of claim 20, wherein a process time of the electrical field treatment is from about 1 hr to about 90 hrs.

[c23] 23. The method for fabricating a solid-state polymer electrolyte film of claim 19, wherein the step of coating the uniform solution on the plate electrode, the container or the surface of an object comprises immersion, spin-coating, spreading or mechanical printing.

[c24] 24. A method of enhancing conductivity of a nano-tube polymer electrolyte, comprising: performing an electrical field treatment for the nano-tube polymer electrolyte at a temperature higher than a Tg of a polymer substrate for about 1 hr to about 90 hrs and cooling down to room temperature.

[c25] 25. The method of enhancing conductivity of a nano-tube polymer electrolyte of claim 24, wherein an electrical field of the electrical field treatment is from about 200 to about 10,000 V/cm.

[c26] 26. A method for fabricating a nano-tube TiO_2, comprising:
uniformly mixing a TiO2 powder and a strong base liquid, heating and cooling downing to room temperature

for forming a solution with solid powder; and
washing the solid powder with acid solution and washing the solid powder with de-ionized water until a solution PH value thereof is near to neutral for generating nano-tube TiO_2.

[c27] 27. The method for fabricating a nano-tube TiO_2 of claim 26, wherein a temperature of the heating step is from about 100 ℃ to about 300 ℃.

[c28] 28. The method for fabricating a nano-tube TiO_2 of claim 26, wherein a process time of the heating step is from about 1 hr to about 50 hrs.

[c29] 29. The method for fabricating a nano-tube TiO_2 of claim 26, wherein a rate of the cooling down step is from about 30 ℃/hr to about 50 ℃/hr.

[c30] 30. The method for fabricating a nano-tube TiO_2 of claim 26, wherein the TiO_2 powder is generated by a process or a mechanical grinding.